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EP 0288743 A1 EP 0210548 A2 US 5042566 A
US 4828018 A US 4802405 A

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(54) Air conditioning apparatus for a vehicle

(57) Air conditioning apparatus for a vehicle comprises a case (2) containing a heat exchanger (4) for cooling air and downstream thereof a heat exchanger(5) for heating air, said case including separate face air outlets (15 and 25) for front and rear seats, and a foot air outlet (13b) for said front seat, and a cool air bypass passage(21) having an inlet immediately downstream of the cooling heat exchanger leading directly to said face air outlet (15) for said front seat and bypassing said heating heat exchanger, and a cool air supply passage for said rear seat branched from said cool air bypass passage at a downstream side of said cool air inlet, and means for adjusting air flowing into said cool air bypass passage and said air supply passage.

FIG. 1

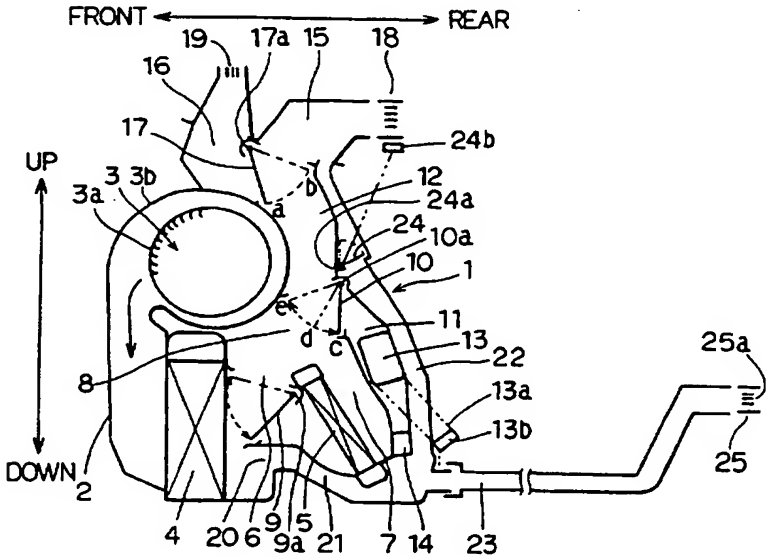

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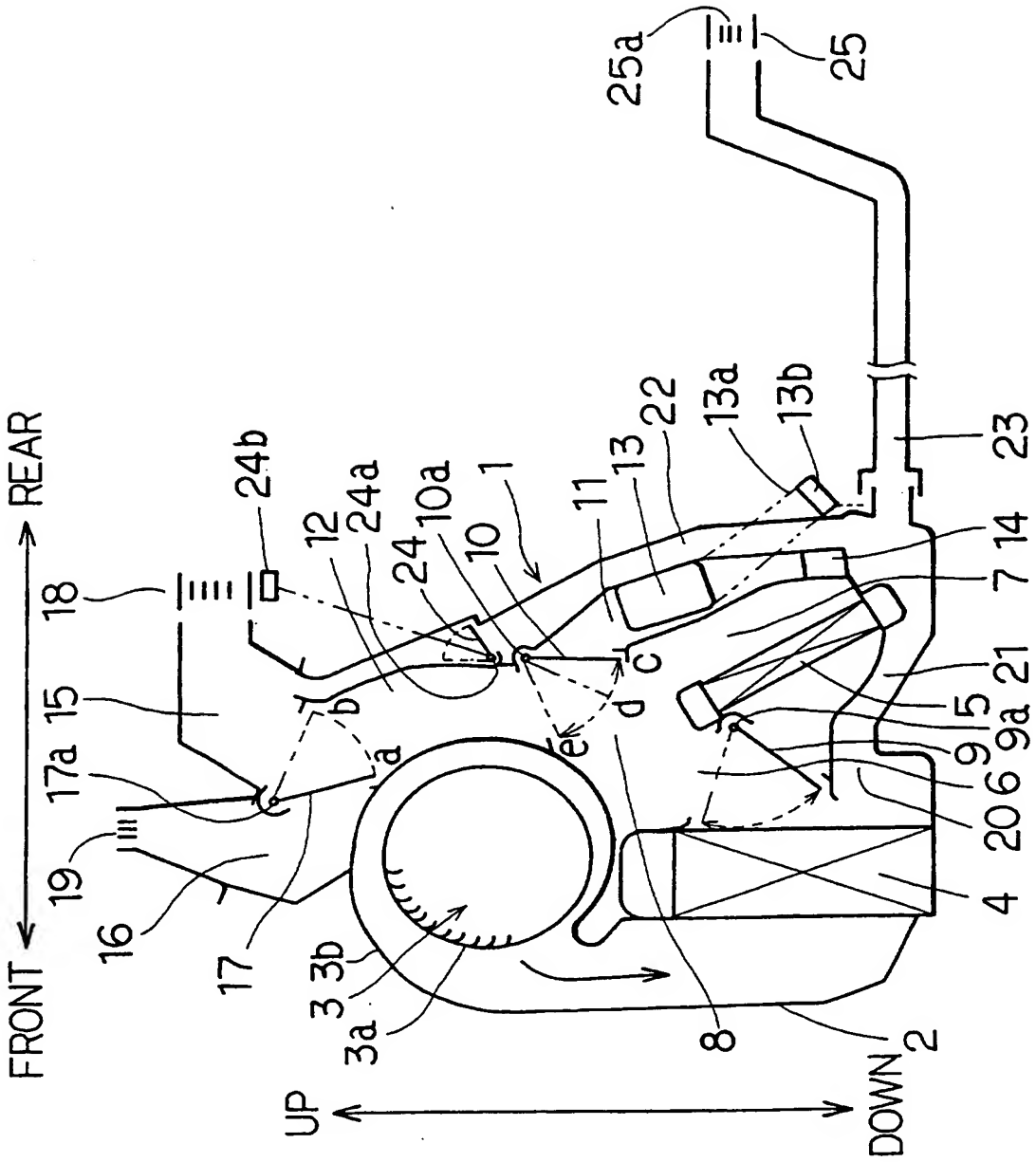
FIG. 1



AIR CONDITIONING APPARATUS FOR VEHICLE

The present invention relates to an air conditioning apparatus for a vehicle, and especially relates to an air conditioning unit in which a function for blowing cool air toward a rear-seat and a function for blowing cool air toward a front-seat are performed by using a common inlet of cool air.

Conventionally, in the air conditioning apparatus for a vehicle, there has been known a construction in which an air conditioning unit equipped integrally with an evaporator, a heater core, and a blower is disposed in a center portion of an instrumental panel at a front portion within a passenger compartment.

In the air conditioning unit, to set a temperature of air blown out from a face air outlet located at an upper side to be lower than that blown out from a foot air outlet located at a lower side, there may be often employed a cool air bypass function in which cool air flowing from a downstream side of an evaporator bypasses the evaporator directly into a face air outlet. Further, to improve a cool feeling at the rear-seat side, there may be also employed a function for blowing cool air at the rear-seat side, in which a face air outlet is also provided at the rear-seat side and a cool air flowing from a downstream side of an evaporator is introduced into the face air outlet.

In this case, generally, two air inlets of cool air are provided at a position immediately downstream the evaporator,

and one of two air inlets is connected to the cool air bypass passage whereas the other is connected to a cool air outlet passage of the face air outlet for the rear-seat.

In the above-described conventional apparatus, however, since two air inlets of cool air are provided at a position immediately downstream the evaporator, there are problems in that, a space for a portion where air inlets are formed expands, the air conditioning unit becomes large-sized, and the construction of the air passage of the air conditioning unit becomes complicated.

In view of the above-described problems, an object of the present invention is, in an air conditioning apparatus for vehicle, in which the cool air bypass function at the front-seat side and the function for blowing cool air at the rear-seat side are performed, to reduce a space for the portion where the air inlets are formed and to simplify the construction of the air passage of the air conditioning unit.

According to the present invention, in view of the point in which the cool air supply function for the rear seat is employed in mainly summer season and the cool air bypass function for the front seat is employed to mainly prevent the face portion of the passenger from being burned in winter season, that is, both functions are employed in different seasons, a single cool air inlet is commonly employed for the cool air supply function for the rear seat and the cool air bypass function for the front seat.

More specifically, according to the present invention,

an cool air inlet is opened at a portion immediately downstream a cooling heat exchanger, cool air taken in from the cool air inlet is introduced directly into a face air outlet for the front seat through a cool air bypass passage, and a cool air supply passage for the rear seat, which is branched from the cool air bypass passage, is provided at a downstream side of the cool air inlet to introduce cool air from the cool air inlet into a face air outlet for the rear seat through a cool air supply passage for the rear seat. Further, there is provided flow adjustment means for adjusting an air flowing into the cool air bypass passage for the front seat and the cool air supply passage for said rear seat.

According to this construction, the cool air taken in from the single cool air inlet can be introduced to be divided into the face air outlet for the front seat and the face air outlet for the rear seat. Then, by adjusting an air flow direction with flow adjustment means, in mainly summer season, the cool air is blown out from the face air outlet for the rear seat to secure the cool air supply function for the rear seat, thereby enhancing the cooling feeling at the rear seat. On the other hand, in winter season, the cool air is blown out from the face air outlet for the front seat to prevent the face portion of the passenger from being burned, thereby controlling a heating feeling satisfactorily.

Further, since the cool air inlet for the cool air supply function at the rear seat side and the cool air inlet for cool air bypass function at the front seat can be commonly

employed, it is possible to reduce a space for the portion where the air inlets are formed and to simplify the construction of the air passage of the air conditioning unit.

As a result, by downsizing an entire shape of the air conditioning apparatus, even in the vehicle having a limited space within the passenger compartment, it is easy to mount the air conditioning unit and to reduce the cost by way of the compactness and simplicity of the air conditioning unit.

Further, even when the cool air taken in from the single cool air inlet is divided into the face air outlet for the front seat and the face air outlet for the rear seat, since the cool air supply function for the rear seat is employed in mainly summer season and the cool air bypass function for the front seat is employed in mainly winter season, there is almost no adverse influence on an air conditioning performance due to the common cool air inlet.

The foregoing and further objects, features and advantages of the present invention will become apparent from the following description of preferred embodiments with reference to the accompanying drawing, wherein:

FIG. 1 is a cross sectional view of an embodiment of the present invention.

The present invention will be described hereinafter

with reference to a preferred embodiment shown in the drawing.

In FIG. 1, the numeral 1 denotes an air conditioning unit, which is located at a lower portion of an instrumental panel, of an air conditioning apparatus within a passenger compartment. In this embodiment, the air conditioning unit 1 is disposed substantially at a center portion in a width direction, of the instrumental panel of a front portion within the passenger compartment. The air conditioning unit 1 includes a case 2 made of resin such as polyptopylene.

The case 2 forms therein an air passage and contains equipments including a heat exchanger (described later) or the like. Further, the case 2 is, as being known well, divided into a plurality of divided case bodies. The plurality of divided case bodies are structured, after containing the equipments including the heat exchanger (described later), a door or the like, to be integrally joined together by proper joining means such as a metal clip and a screw fixture.

The numeral 3 denotes a blower disposed at a front side of the vehicle within the air conditioning unit 1 and being of a known type including a centrifugal multi-blade fan 3a and a motor (not shown) for actuating the fan 3a. The blower 3 introduces outside air or inside air through a known inside air/outside air switching box (not shown) and blows air in the air passage within the case 2.

The numeral 4 denotes an evaporator disposed at a front side of the vehicle and at a lower side portion of the blower 3. The evaporator 4 constructs a known refrigerating cycle

with a compressor, a condenser, receiver, and a pressure reducer (these are not shown) and functions as a cooling heat exchanger. The compressor of the refrigerating cycle is actuated by an engine for a vehicle through an electromagnetic clutch (not shown).

The numeral 5 denotes a heater core disposed at an air downstream side of the evaporator 4 and at a lower portion of the rear side of the vehicle within the case 2. The heater core 5 is a heating heat exchanger for heating air by cooling water of the engine for the vehicle as heat source and reheats air cooled by the evaporator 4.

The numeral 6 denotes a bypass passage formed at an air downstream side of the evaporator 4 and at a lower portion of the heater core 5. In the bypass passage 6, the cool air cooled by the evaporator 4 flows to bypass the heater core 5. The numeral 7 denotes a warm air passage formed to extend upward from an air downstream side of the heater core 5, in which warm air heated by the heater core 5 flows.

The numeral 8 denotes a cool air/warm air mixing chamber formed at a portion where the cool air from the bypass passage 7 and the warm air from the warm air passage 7 join together to mix the cool air and the warm air.

The numeral 9 denotes an air mixing door for adjusting a temperature, disposed in a space between the evaporator 4 and the heater core 5 and being rotatable with an axis 9a disposed close to an upper end portion as a center. By an opening degree of the air mixing door 9, an air amount ratio between

the bypass passage 6 and the warm air passage 7 is adjusted so that a temperature of the air blown out into the passenger compartment is adjusted.

The numeral 10 denotes a foot door disposed at an upper side of the cool air/warm air mixing chamber 8 within the case 2 and being rotatable with an axis 10a as a center. The foot door 10 is for switching a communication with a foot air passage 11 or a face/defroster passage 12.

The foot air passage 11 extends downward from an upper side to a lower side at the rear side of the vehicle, and a foot air opening is opened at the midway of the foot air passage 11. To the foot air opening 13 connected two of a right foot passage 13a at a driver seat side and a left foot passage 13a at a passenger seat side. At top ends of the two of right and left foot passages 13a, there are provided a foot air outlet 13b at the driver's seat and a foot air outlet 13b at the passenger's seat, both for blowing air toward feet of the passenger.

In FIG. 1, for convenience of preparing the drawing, the foot passage 13a and foot air outlet 13b are shown to protrude toward the rear side of the vehicle; however, actually, the foot passage 13a and the foot air outlet 13b are positioned at both sides in the left-and-right direction with reference to the foot air opening 13, and extends downward therefrom.

At a lower end portion of the foot air passage 11, a foot air opening 14 at the rear seat side is opened. To the

foot air opening 14 at the rear seat side connected a foot passage (not shown) for the rear seat. At the top end of the foot passage for the rear seat, there provided a foot air outlet (not shown) for blowing air toward feet of a passenger at the rear seat.

On the other hand, an upper side (air downstream side) of the face/defroster passage 12 is branched off into two air passages which form a face air passage 15 and a defroster air passage 16, respectively. At the branched portion of both passages 15 and 16, there provided a face/defroster door 17. The door 17 is rotatable with an axis 17a as a center, to switchingly open or close both passages 15 and 16.

In the face air passage 15, there is provided a face air outlet 18 for the front seat, for blowing air an upper side of the front seat. The face air outlet 18 includes, as being known well, a center face air outlet for blowing air an upper half body of the passenger from a center portion in the left-and-right direction of the passenger compartment and side face air outlets for blowing air toward both of a left side portion and a right side portion of the upper half body of the passenger in the passenger compartment from both of a left end portion and a right end portion of the instrumental panel. Each of these face air outlet is equipped with a known grille mechanism (not shown) for deflecting an air flow direction.

At a top end portion of the defroster air passage 16, there is provided a defroster air outlet 19 for blowing air toward a front windshield of the vehicle.

The above-described two mode-switching doors 10 and 17 operate interlockingly while being connected with a link mechanism (not shown). The link mechanism may be of a known type, for example, which rotates the doors 10 and 17 by transmitting a manual operating force applied to a manual operating lever (operating lever for switching air mode) of an air conditioning control panel (not shown) provided in the instrumental panel within the passenger compartment, through a control cable. Alternatively, the doors 10 and 17 may be rotated by actuating the link mechanism with an actuator such as a servomotor, which is automatically controlled by an air conditioning control apparatus. Similarly, an opening degree of the air mixing door 9 is also adjusted by a manual operating force applied to a manual operating lever (temperature adjusting lever) of an air conditioning panel (not shown).

The numeral 20 denotes a cool air inlet disposed at an immediately downstream side of the evaporator 4 and opened at a lower side, for taking in cool air cooled by the evaporator 4. In this embodiment, the cool air inlet 20 is provided at a lower side of the air mixing door 9. The cool air inlet 20 is connected to a cool air passage 21 extending from a lower side of the heater core 5 toward the rear side of the vehicle. The cool air passage 21 is branched off into a cool air bypass passage 22 for the front seat and a cool air supply passage 23 for the rear seat at a rear end portion of the vehicle.

The cool air bypass passage 22 extends from a lower side to an upper side at the rearmost portion of the vehicle in

the air conditioning unit 1 and is connected to a downstream portion of the face/defroster door 17. That is, an upper end portion of the cool air bypass passage 22 for the front seat is directly communicated with a portion immediately before the face air outlet for the front seat.

The numeral 24 denotes a cool air bypass door disposed in the midway of the cool air bypass passage 22 for the front seat, for opening or closing the bypass passage 22. The cool air bypass door 24 is rotatable with an axis 24a as a center. The cool air bypass door 24 is connected to an manual operating knob 24b disposed close to (at a lower side portion of) the face air outlet 18 for the front seat. The cool air bypass door 24 is opened or closed by a manual operation of the knob 24b. The knob 24b and the cool air bypass door 24 are connected with known connecting means such as a link and a cable.

Further, the cool air supply passage 23 is disposed along a center console between the driver's seat and the assistant passenger's seat, and bends upward at the rear end surface of the center console. The face air outlet 25 for the rear seat is disposed at an upper end portion thereof. The face air outlet 25 is equipped with a known grille mechanism 25b capable of opening or closing a supply of air and deflecting an air flow direction. In this embodiment, the cool air bypass door 24 and the grille mechanism 25b constructs adjusting means for adjusting an air flowing into the cool air bypass passage 22 for the front seat and the cool air supply

passage 23 for the rear seat.

Next, an operation of the above-described construction will be described. When the blower 3 is operated, inside air or outside air is sucked from the inside air/outside air switching box (not shown), and the sucked air flows downward from the air outlet portion of the scroll casing 3b of the blower 3. The air turns a direction thereof toward the rear side of the vehicle at the upstream side of the evaporator 4 and is blown out toward the evaporator 4. The blown air is cooled in the evaporator 4 to be cool air.

Subsequently, cool air is branched in accordance with an opening degree of the air mixing door 9 and flows into the bypass passage 6 and the warm air passage 7 at the side of the heater core 5. The air flowing into the heater core 5 is reheated by the heater core 5 to be warm air and flows in the warm air passage 7. The warm air flowing from the warm air passage 7 and the cool air flowing from the bypass passage 6 are mixed in the cool air/warm air mixing chamber 8 to be conditioned air having a desired temperature. Then, the conditioned air flows through any one of or a plurality of selected air supply passages and is blown out into the passenger compartment from a predetermined air outlet(s).

Since the above description is a summary of the operation of the entire air conditioning apparatus, an air flow direction in each of air outlet modes will be briefly described next.

When an operator operates the air outlet mode switching

lever of the air conditioning control panel, the operating force is transmitted to the two mode-switching doors (the door for face/defroster and the door for foot) 10 and 17 through the control cable and the link mechanism. The both doors 10 and 17 are interlockingly operated, and a predetermined air outlet mode is set.

Firstly, the "face mode" will be described. When the face/defroster door 17 is operated at a position "a" in FIG. 1, the defroster air supply passage 16 is fully closed, and the face air supply passage 15 is fully opened. Further, the foot door 10 is operated at a position "c" in FIG. 1, and the foot air supply passage 11 is fully closed.

In this way, conditioned air from the cool air/warm air mixing chamber 8 flows into the face air supply passage 15 for the front seat and is blown out toward an upper side within the passenger compartment to cool the front seat side.

At this time, in summer season, when the rear seat side needs to be cooled, the cool air bypass door 24 is operated at a closed position by the manual operating knob 24b, and the grille mechanism of face air outlet 25 for the rear seat is maintained to be opened. In this way, the cool air taken in from cool air inlet 20 flows through the cool air passage 21 and the cool air supply passage 23 for the rear seat, reaches the face air outlet 25 for the rear seat, and is blown out therefrom into an upper side of the rear seat. Therefore, it is possible to cool the rear seat side satisfactorily.

If the cool air bypass door 24 is operated at an open

position, the cool air flows through the cool air bypass passage at the front seat side, and an amount of cool air which reaches the face air outlet for the rear seat is reduced; however, in this case, the cool air bypass passage 22 and the cool air supply passage for the rear seat are designed such that an air resistance in the cool air supply passage 23 is smaller than that in the cool air bypass passage, and therefore, the amount of cool air flowing into the face air outlet 25 for the rear seat is larger.

When the passenger is absent at the rear seat, the grille mechanism 25a of the face air outlet 25 for the rear seat is closed. Further, by operating the cool air bypass door 24 is operated at an open position, an amount of cool air flowing through the cool bypass passage 22 can be introduced into the face air supply passage 15 for the front seat, and therefore, the amount of cool air blown out from the face air outlet 18 for the front seat can be increased as much.

Next, a "bi-level mode" will be described. When the face/defroster door 17 is operated at a position "a" in FIG. 1, the defroster air supply passage 16 is fully closed, and the face air supply passage 15 is fully opened. On the other hand, The foot door 10 is operated at an intermediate opening position "d" in which the foot door 10 is slightly opened from the fully closed position "c" in FIG. 1 to open the foot air supply passage 11 slightly.

In this way, a part of conditioned air from the cool air/warm air mixing chamber 8 flows into the foot air supply

passage 11, passes through a left foot passage 13a at the driver's seat side and a right foot passage 13a at the assistant passenger's seat side from the foot air opening 13, and is blown out from the foot air outlet 13b at the driver's seat side and the foot air outlet 13b at the assistant passenger's seat side toward feet of the passenger at the front seat. Further, a part of conditioned air having flowed into the foot air supply passage 11 passes through the foot passage for the rear seat from the foot air opening 14 at the rear seat side, and is blown out from a foot air outlet (not shown) toward feet of the passenger at the rear seat.

Simultaneously, conditioned air from the cool air/warm air mixing chamber 8 passes through the face/defroster passage 12, flows into the face air supply passage 15, and is blown out from the face air outlet 18 for the front seat into an upper side within the passenger compartment.

Next, a "foot mode" will be described. When the face/defroster door 17 is operated at a position "b", the defroster air supply passage 16 is fully opened, and the face air supply passage 15 is fully closed.

On the other hand, the foot door 10 is operated at the maximum opening degree position "e" in FIG. 1, an opening degree of the foot air supply passage 11 is widened substantially at the maximum amount, and the cool air/warm air mixing chamber 8 are communicated with the face/defroster passage 12 through a minute passage.

Thus, most of the conditioned air from the cool

air/warm air mixing chamber 8 flows into the foot air supply passage 11 and is blown out toward feet of the passenger from the foot air outlet 13b at the front seat side and the foot air outlet at the rear seat side. Simultaneously, a part of the conditioned air passes through the face/defroster passage 12 and the defroster air supply passage 16, and is blown out toward a front windshield of the vehicle from the defroster air outlet 19 to prevent the front windshield of the vehicle from being frosted.

Next, a "foot/defroster mode" will be described. The face/defroster door 17 is operated at a position "b" in FIG. 1, and the foot door 10 is operated at an intermediate opening degree position "d" in FIG. 1.

In this way, approximately half of the conditioned air from the cool air/warm air mixing chamber 8 flows into the foot air supply passage 11, and is blown out toward feet of the passenger from the foot air outlet 13b at the front seat side and the foot air outlet at the rear seat side. Simultaneously, the remaining approximately half of the conditioned air is blown out from the defroster air outlet 19. Accordingly, an amount of the air flowing from the defroster air outlet 19 is increased to further improve the defrosting effect of the windshield.

Next, a "defroster mode" will be described. The face/defroster door 17 is operated at a position "b" in FIG. 1, and the foot door 10 is operated at a position "c" in FIG. 1, so that the foot air supply passage 11 is fully closed.

In this way, all of the conditioned air from the cool air/warm air mixing chamber 8 flows through the defroster air supply passage 16 and is blown out toward the front windshield of the vehicle from the defroster air outlet 19. Accordingly, an amount of the air blown out from the defroster outlet 19 is further increased to improve the defrosting effect of the windshield greatly.

The above-described "foot mode", "foot/defroster mode", and "defroster mode" are often employed in winter season; however, at that time, if these operation modes are continued for long time period, the warm air ascends upward within the passenger compartment by natural convection so that the passenger may feel uncomfortable, because a face portion of the passenger is burned.

In such a case, the cool air bypass door 24 is operated at an open position by the manual operating knob 24b, and the grille mechanism 25a of the face air outlet 25 for the rear seat is set to be closed. In this way, the cool air taken in from the cool air inlet 20 flows into through the cool air passage 21 and the bypass passage 22 for the front seat, reaches the face air outlet 18 for the front seat, and is blown out therefrom into an upper portion at the front seat side. Therefore, the face portion of the passenger at the front seat side is prevented from being burned, and it is possible to give a comfortable air conditioning feeling in which the head portion is cooled and the foot portion is heated.

Also in the "bi-level mode", similar to the above, the

cool air bypass door 24 is opened, and the grille mechanism 25a of the face air outlet 25 for the rear seat is closed, to enhance the state in which the head portion is cooled and the foot portion is heated, at the front seat side.

(The other embodiments)

The present invention is not limited to the above-described embodiment, but is embodied in various modifications. For example, in the above-described embodiment, the air conditioning apparatus for a vehicle, being of a so-called air mixing type in which the ratio between an amount of cool air and an amount of warm air is adjusted by the air mixing door 9 so that a temperature of the blown air is adjusted, is described; however, the present invention can be employed in an air conditioning apparatus for a vehicle, being of a hot water flow amount adjustment type or the like, in which a temperature of the blown air by adjusting an amount of hot water flowing into the heater core 5.

Further, in the above-described embodiment, an embodiment in which the cool bypass door 24 is directly operated by an manual operation with the manual knob 24b is described; however, for example, when a temperature of the passenger compartment is increased in a foot mode in winter season, a condition in which the passenger at the front seat feels that the face portion is burned may be detected from the temperature of the passenger compartment or the like, and the cool air bypass door 24 may be automatically opened by an electric control apparatus for air conditioning.

Still further, in the above-described embodiment, the cool air bypass door 24 is disposed at the midway of the cool air bypass passage 22 for the front seat; however, for example, the cool air bypass door 24 may be disposed at a branched portion between the cool air bypass passage 22 for the front seat and the cool air supply passage for the rear seat to switch therebetween.

While the present invention has been described with reference to what are presently considered to be preferred embodiments thereof, it is to be understood that the invention is not limited to the disclosed embodiments. To the contrary, the invention is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

CLAIMS

1. An air conditioning apparatus for a vehicle having a front seat and a rear seat, comprising:

a cooling heat exchanger for cooling air flowing therethrough;

a heating heat exchanger disposed at a downstream side of said cooling heat exchanger, for reheating air flowing therethrough to a predetermined temperature;

a case for containing said cooling heat exchanger and said heating heat exchanger,

said case having a face air outlet which is for blowing air having passed through said heating heat exchanger toward an upper space at said front seat side, a foot air outlet for said front seat, into which air having passed through said heating heat exchanger is introduced and which is for blowing air toward a lower space at said front seat side, a face air outlet for said rear seat, which is for blowing air toward an upper space at said rear seat side, and a cool air inlet opened at a portion immediately downstream said cooling heat exchanger, which is for taking in cool air cooled by said cooling heat exchanger,

said case being for forming therein a cool air bypass passage for said front seat, which is for introducing cool air taken in from said cool air inlet to bypass said heating heat exchanger directly into said face air outlet for said front seat, and a cool air supply passage for said rear seat, branched from said cool air bypass passage for said front seat

at a downstream side of said cool air inlet, which is for introducing cool air taken in from said cool air inlet to said face air outlet for said rear seat; and

flow adjustment means for adjusting an air flowing into said cool air bypass passage for said front seat and said cool air supply passage for said rear seat.

2. An air conditioning apparatus according to claim 1, wherein,

said cooling heat exchanger is disposed at a front side of said vehicle in said case,

said heating heat exchanger is disposed at a rear side of said vehicle in said case,

said cool air inlet is formed at a portion immediately downstream said cooling heat exchanger and at a lower side of said case, and

said case further has a cool air passage extending at a lower side portion of said heating heat exchanger toward a rear side of said vehicle, to which said cool air inlet is connected, said cool air passage is branched off at a portion of a rear end of said vehicle, into said cool air bypass passage for said front seat and said cool air supply passage for said rear seat.

3. An air conditioning apparatus according to claim 1 or claim 2, wherein a downstream end of said cool air bypass passage is connected to a portion immediately before said face

air outlet for said front seat.

4. An air conditioning apparatus according to any one of claims 1 to 3, wherein flow adjustment means includes a cool air bypass door for opening or closing said cool air bypass passage for said front seat and a grille mechanism for intermitting an air flow.

5. An air conditioning apparatus according to any one of claims 1 to 4, wherein said cool air inlet is single.

6. An air conditioning apparatus substantially as described herein with reference to the accompanying drawing.

The Patent Office

22.

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Claims searched: All

Examiner: Paul Gavin
Date of search: 12 June 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): F4V(VCF,VFD,VGAA)

Int Cl (Ed.6): B60H(1/00)

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	EP 0 288 743 A1	(DIESEL KIKI CO. LTD.) - whole doc.	1 at least.
X	EP 0 210 548 A2	(BAYERISCHE M. W.) - see enclosed abstract AN 87-030471	1 at least.
X	US 5 042 566	(SIEMENS AG) - whole doc.	1 at least.
X	US 4 828 018	(GENERAL MOTORS CORP.) - whole doc.	1 at least.
X	US 4 802 405	(NIPPONDENSO et al) - whole doc.	1 at least.

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.